Space Weather Technical Forecast

Issued on Tuesday, 03 May 2022 at 01:16 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: No significant geomagnetic activity. Potential R1-R2 blackouts from regions across northwestern and southeastern limb.

Analysis of Space Weather Activity over past 24 hours
Solar Activity: Solar activity has been Low through the last 24 hours, with one significant C-class flare, a C3.2 at 02/1920UTC, which emanated from the returning region, previously ex-2992, just behind the southeast limb. There are four numbered sunspot regions on the visible disc, two simple alpha regions and two newly emerged regions. One of these new regions is 3004 (Cro/Beta) in the southeast with the other, 3005 (Bxo/Beta) in the northeast. Two further regions have also currently become visible, a re-emergence of 2997 in the northwest and a new beta region in the southeast. A number of CMEs were observed being emitted from the farside of the Sun, but none of these have been assessed as Earth-directed.

Solar Wind / Geomagnetic Activity: The solar wind, observed at L1, has very slowly declined from 475km/s to 440km/s as the high speed stream from coronal hole 78 wanes. The solar wind has generally been noisy with small fluctuations, but there was a settled spell between 02/1400UTC and 02/1600UTC which may have been representative of a glancing CME. Density was below average, but with a similar settled spell at the same time as for the solar wind speed. Total interplanetary magnetic field strength has been weak, but with a slight jump at 02/1428UTC. The north-south component, Bz, varied weakly, but switched from +2nT to -2nT at 021428UTC with a magnetometer signature which suggests the passage of a CME. Phi angle has been persistently negative (towards the Sun), but has been more perturbed since 02/1428UTC. Despite the potential weak CME, geomagnetic activity started Unsettled, but has been Quiet through the remainder of the last 24 hours.

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV) has been at background through the last 24 hours. High energy electron flux (greater than 2MeV) has varied between moderate and high levels, peaking at 1540 pfu 02/1540UTC. 24-hour integrated fluence initially followed a rising trend, but has since plateaued, reaching 6.63e7 integrated pfu at 02/2100UTC.

Four-Day Space Weather Forecast Summary
Solar Activity: Low or Very Low at first, with currently inactive regions on the visible disc. The emergence of two regions across the eastern limb is expected to increase activity to Moderate from 03 May due to the observed flare activity from the regions as they move closer to the limb.

Solar Wind / Geomagnetic Activity: No Earth-directed CMEs are forecast. The current high speed stream from coronal hole 78 will continue to wane through 03 May, with no further high speed streams expected to affect the Earth during the forecast period. Initially Quiet, with isolated Unsettled intervals, becoming Quiet through the period.

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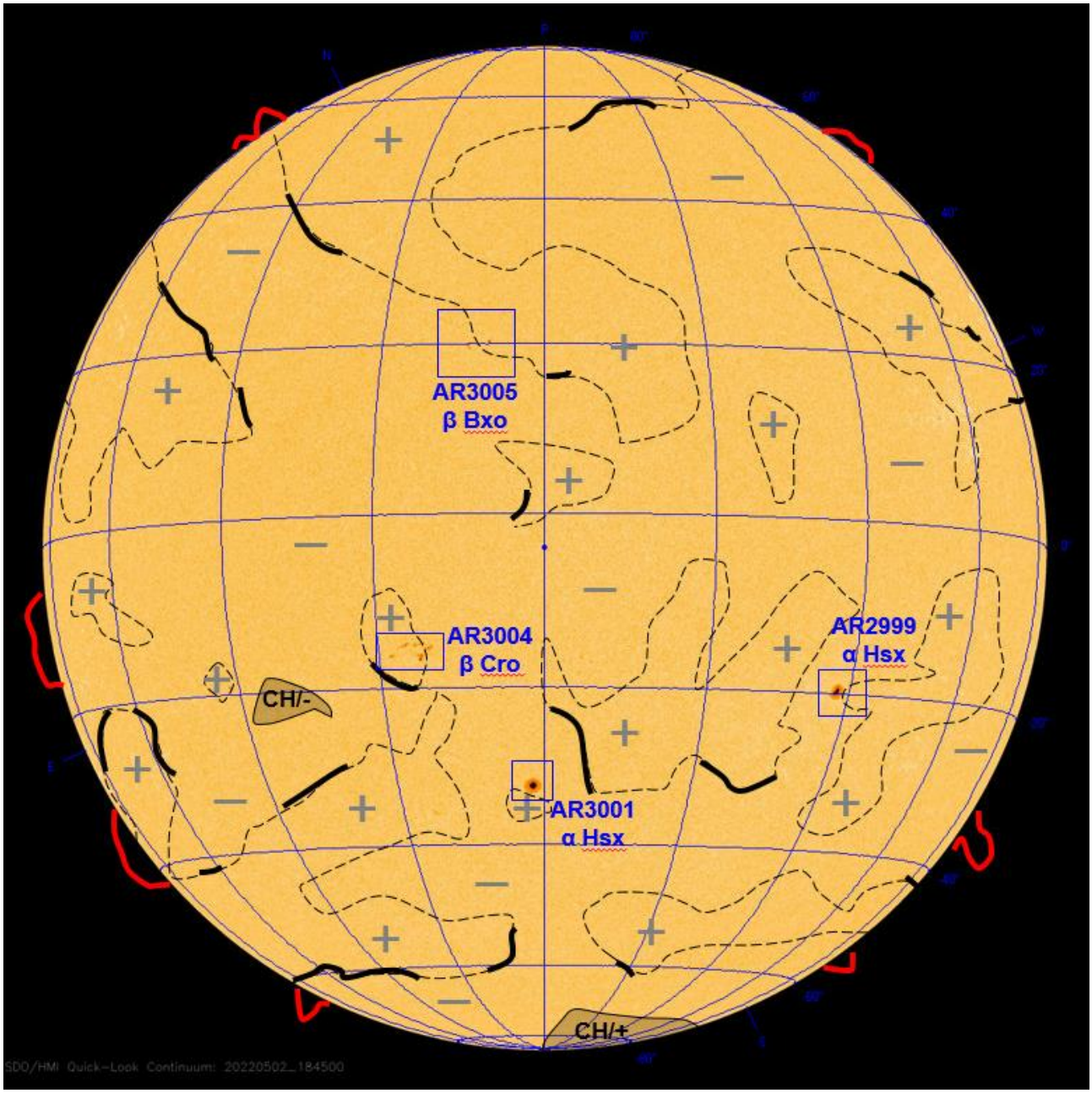
Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) is at background, with a very slight risk of radiation storms from any flare emanating from ex-2994 beyond the northwest limb. High energy electron flux (greater than 2MeV) is expected to continue to exceed the high (1e3 pfu) threshold during the period, with slightly declining peaks. Electron fluence is increasingly less likely to reach the Active (1e8 integrated pfu) through the next four days as a result of the expected declining flux.

Figure 1. Solar Analysis Valid 02/2000UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

No Earth-directed CMEs are currently forecast.
The high speed stream from coronal hole 78 will continue to gradually wane, perhaps reaching ambient level by the end of 03 May with no further high speed stream connections forecast in the next four days.

Geomagnetic activity is expected to be Quiet throughout.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: Solar wind parameters through the last 24 hours. The probable weak CME passage is indicated in the red box

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Radio Blackouts - X-Ray Flares:
All four numbered sunspot regions are currently simple and benign. Two further regions are also starting to develop, 2997 which appears to be re-emerging in the northwest quadrant and a new region appears to be developing in the southeast.

Ex-2994 which moved across the limb three days ago, is still producing flare activity which is visible over the northwest limb due to the elevation of the magnetic looping into the corona. The magnitude of any flares from this region will decrease through the next few days as the region moves further onto the far side. A new region on the southeast limb will move onto the visible disc in the next 24 hours. This region, which appears to be a return of ex-2992, already carried a recent history of activity, with a number of C-class flares visible from beyond the southeast limb through last few days. There is also the potential for further active regions to rotate onto the northeast limb, with high flux discernible on STEREO-A EUVI imagery.

Solar activity is expected to start Low or Very Low, but with an increasing risk of Moderate activity focused on the potential regions rotating across the eastern horizon during 03 May.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	10	10	10	10
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: GOES 16 X-ray flux

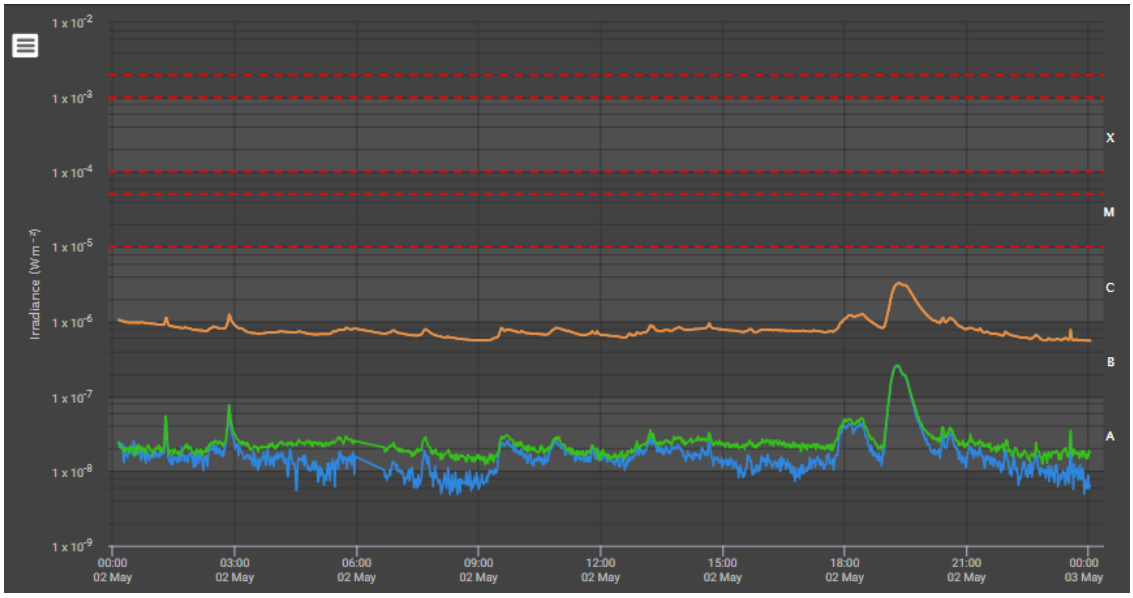

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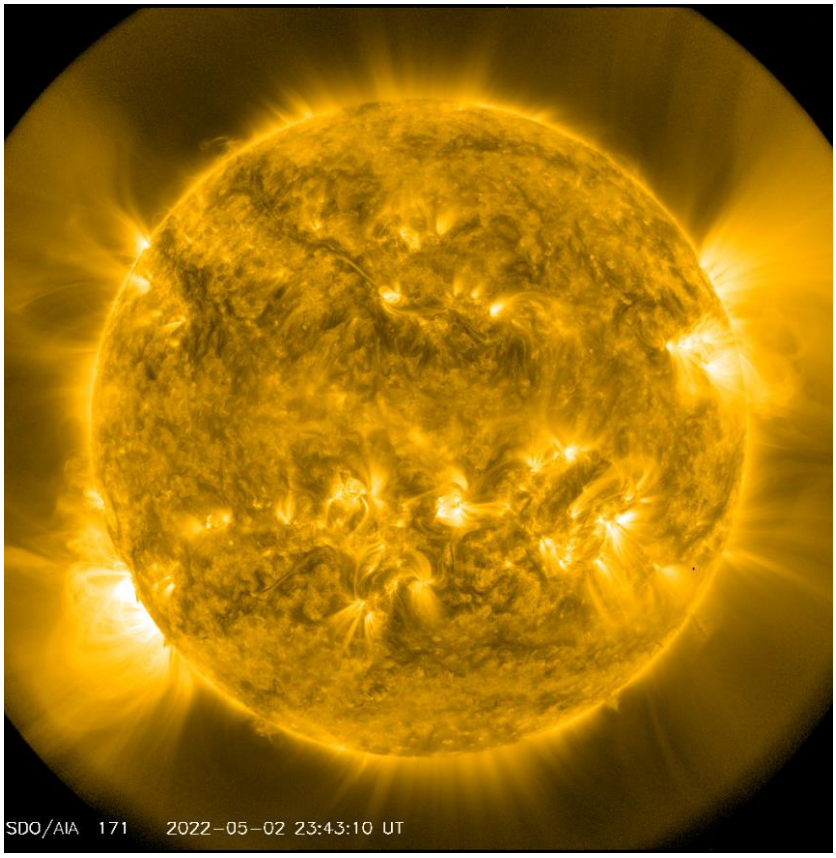
Figure 4: SDO AIA 171 imagery, with the looping in the top-right (northwest) and bottom-left (southeast) clearly visible.



Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) as measured by GOES-16 at GEO is at background levels, and is most likely to remain so through the next four days.

The activity and flaring from ex-2994 and neighbouring regions are still visible at Earth, with a risk of radiation storms from any energetic flaring. This risk decreases through 03 May (day 1) as the region becomes increasingly occulted behind the visible solar disc.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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High Energy Electrons Event (≥ 2MeV):
The high energy electron flux is expected to be close to the high (1e3 pfu) threshold through the next four days with no significant geomagnetic activity forecast. As there are no expected significant inputs into the radiation belts, the magnitude of the electron flux is likely to slowly decay, albeit still reaching high levels on diurnal peaks.

Due to no significant inputs and a steadily declining electron flux, the electron fluence is increasingly unlikely to exceed the Active (1e8 integrated pfu) through the next four days. This is in line with the general trend indicated by the MOSWOC REFM model.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	40	30	20	20
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 5: GOES 16 electron flux for the last 24 hours

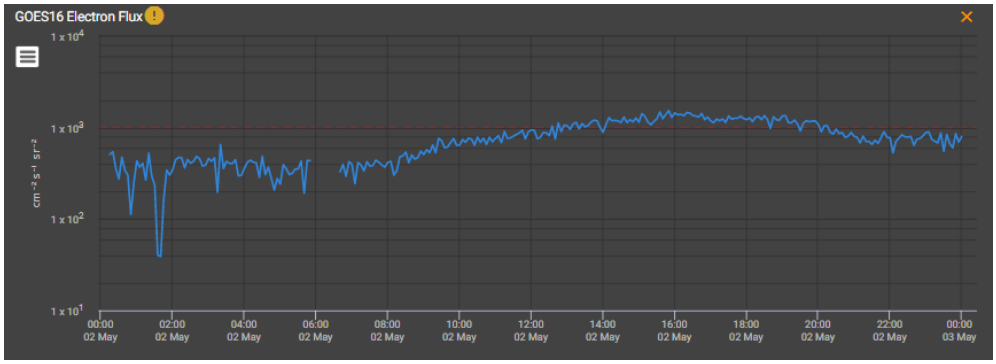
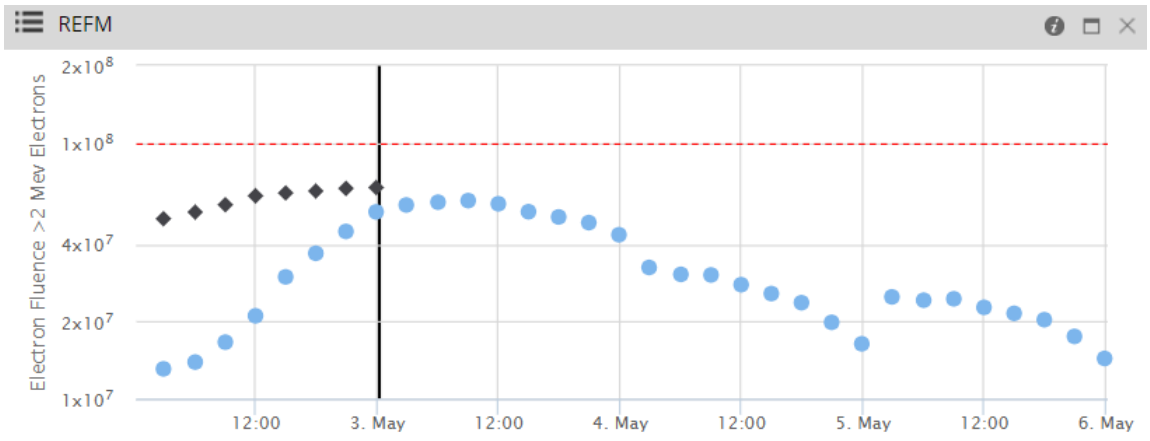


Figure 6: MOSWOC REFM model



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